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# DATA SHEET

# PCF1252-X family
## Threshold detector and reset generator

Product specification
Supersedes data of 1996 Jan 23
File under Integrated Circuits, IC11

1998 Apr 16

Philips
Semiconductors

PHILIPS

# Threshold detector and reset generator PCF1252-X family

## FEATURES

- Very low current consumption, typically 10 μA
- 10 factory programmed threshold voltages available covering trip voltages from 4.75 to 2.55 V
- ±50 mV trip point accuracy over full temperature range
- Variable RESET delay
- RESET pulse polarity selection
- Defined outputs at 0.6 V (typ.)
- Comparator for second level detection (e.g. overvoltage detection)
- Advance warning of power fail
- Operating temperature range –40 to +85 °C.

## GENERAL DESCRIPTION

The PCF1252-Xs are low-power CMOS voltage threshold detectors designed especially for supervision of microcontroller/microprocessor systems for detection of power-on/off conditions and generation of a system reset pulse. The PCF1252-X also provides a $\overline{\text{POWF}}$ (power fail) output which is activated at a precise factory-programmed trip point. A system RESET output has a built-in delay with duration determined by an external capacitor ($C_{CT}$).

A second comparator (comparator 2) has been included to enable the possibility of a second monitoring point in the system.

## ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|---|---|---|---|
| | NAME | DESCRIPTION | VERSION |
| PCF1252-XP(1) | DIP8 | plastic dual in-line package; 8 leads (300 mil) | SOT97-1 |
| PCF1252-XT(1) | SO8 | plastic small outline package; 8 leads; body width 3.9 mm | SOT96-1 |

**Note**

1. X = 0 to 9; depending on threshold voltage.

## BLOCK DIAGRAM

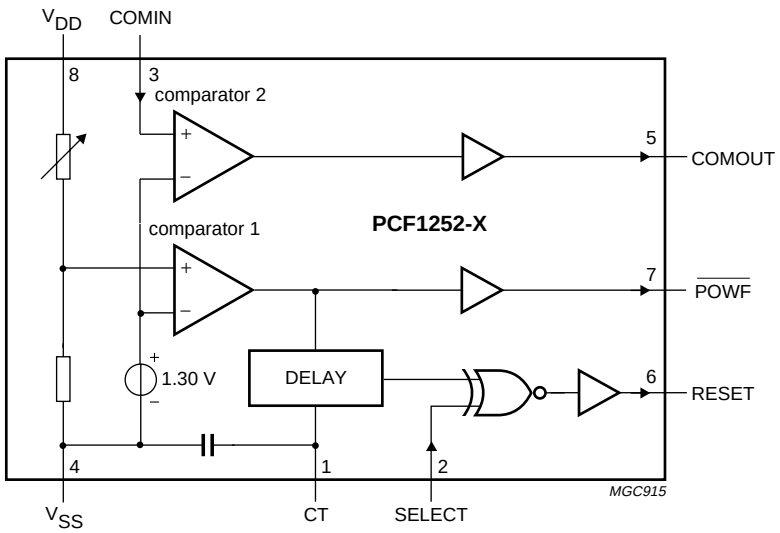



Fig.1 Block diagram.

## PINNING

| SYMBOL | PIN | DESCRIPTION |
|---|---|---|
| CT | 1 | connection for the external capacitor |
| SELECT | 2 | select polarity or external reset input |
| COMIN | 3 | comparator input |
| $V_{SS}$ | 4 | ground (0 V) |
| COMOUT | 5 | comparator output |
| RESET | 6 | reset output |
| $\overline{POWF}$ | 7 | power failure signal output |
| $V_{DD}$ | 8 | supply voltage |

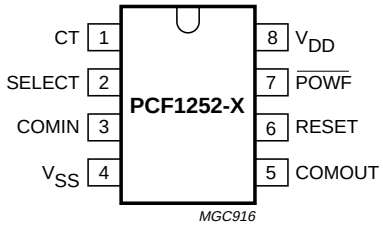



Fig.2 Pinning diagram.

## FUNCTIONAL DESCRIPTION (see Fig.1)

The PCF1252-X contains:

- A precise factory-programmed voltage reference
- Two comparators
- A delay circuit.

The PCF1252-X family is comprised of 10 versions with different factory-programmed voltage trip-points ($V_{TRIP}$), see Chapter “Characteristics”.

### Supply

The supply voltage ($V_{DD}$) is internally divided before being compared, via comparator 1, with the internal reference voltage.

### $\overline{POWF}$ (see Fig.3)

The $\overline{POWF}$ output is:

- LOW, if $V_{DD}$ is below $V_{TRIP}$
- HIGH, if $V_{DD}$ is above $V_{TRIP}$.

### Power-on reset (SELECT = LOW)

As $V_{DD}$ rises past $V_{TRIP}$, a positive reset pulse is generated at RESET. The duration of the reset pulse ($t_R$) is determined by the value of the external capacitor ($C_{CT}$; maximum 1 μF, see Fig.8) connected to CT. With no external capacitor connected, $C_{CT}$ assumes a minimum value of 100 pF. If SELECT is HIGH, the reset pulse is inverted.

### Power failure

During a power-off condition ($V_{DD} < V_{TRIP}$), $\overline{POWF}$ goes LOW. After a time delay ($t_S$), also determined by $C_{CT}$, RESET goes HIGH. Any $\overline{POWF}$ assertion ($V_{DD} < V_{TRIP}$) will result in a subsequent RESET pulse.

### Voltage trip-point

By selecting the voltage trip-point slightly higher than the minimum operating voltage of the microcontroller/microprocessor, there is sufficient time for data storage before the power actually fails.

In order to prevent oscillations around the voltage trip-point, a small hysteresis has been included, resulting in a power-on switching point that is higher than the voltage trip-point (minimum of 15 mV). The voltage trip-point refers to the value at which power-off is signalled.

### COMIN

Input to the second comparator (comparator 2).
When used in conjunction with an external voltage divider, this allows a second point in the system to be monitored. This input has no built-in hysteresis. When not in use connect to $V_{DD}$. COMOUT will be LOW or HIGH depending on the voltage at COMIN:

- COMOUT = HIGH, if voltage at COMIN is above the switch point $V_{SP}$ (typically 1.30 V).
- COMOUT = LOW, if voltage at COMIN is below the switch point $V_{SP}$ (typically 1.30 V).

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{DD}$ | supply voltage | | –0.5 | +7.0 | V |
| $V_I$ | input voltage | | –0.5 | $V_{DD}$ + 0.5 | V |
| $I_I$ | DC clamp-diode current | all pins: $V_I < -0.5$ V or $V_I > V_{DD} + 0.5$ V | – | 20 | mA |
| $I_O$ | output current | | – | 20 | mA |
| $P_{tot}$ | total power dissipation | | – | 150 | mW |
| $T_{stg}$ | storage temperature | | –65 | +100 | °C |
| $T_{amb}$ | operating ambient temperature | | –40 | +85 | °C |

## HANDLING

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be totally safe, it is desirable to take normal handling precautions appropriate to handling MOS devices (see *"Handling MOS Devices"*).

## CHARACTERISTICS

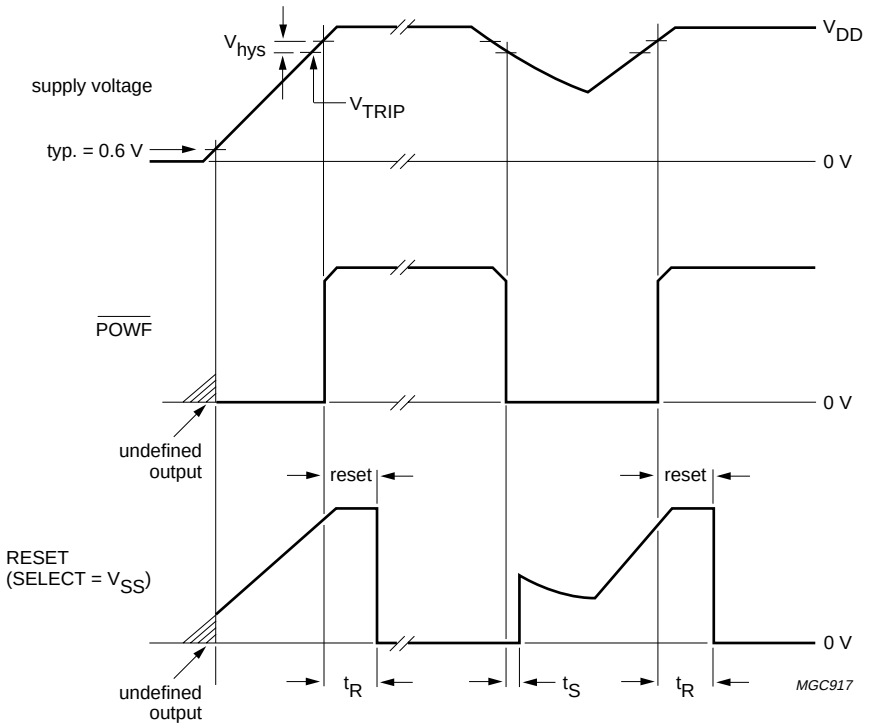
$V_{DD}$ = 2.4 to 6.0 V; $V_{SS}$ = 0 V; $T_{amb}$ = –40 to +85 °C; (see Fig.3); unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{DD}$ | supply voltage | | 2.4 | – | 6.0 | V |
| $V_{TRIP}$ | Voltage trip-point: | $T_{amb}$ = 25 °C; note 1 | | | | |
| | PCF1252-0 | | 4.70 | 4.75 | 4.80 | V |
| | PCF1252-1 | | 4.50 | 4.55 | 4.60 | V |
| | PCF1252-2 | | 4.20 | 4.25 | 4.30 | V |
| | PCF1252-3 | | 4.00 | 4.05 | 4.10 | V |
| | PCF1252-4 | | 3.70 | 3.75 | 3.80 | V |
| | PCF1252-5 | | 3.50 | 3.55 | 3.60 | V |
| | PCF1252-6 | | 3.20 | 3.25 | 3.30 | V |
| | PCF1252-7 | | 3.00 | 3.05 | 3.10 | V |
| | PCF1252-8 | | 2.70 | 2.75 | 2.80 | V |
| | PCF1252-9 | | 2.50 | 2.55 | 2.60 | V |
| $I_{DD}$ | supply current | $T_{amb}$ = 25 °C; $V_{DD} = V_{TRIP} + 0.5$ V; COMIN = $V_{DD}$; see Figs. 4 and 5 | – | 10 | 15 | µA |
| $\Delta V_{TRIP}$ | voltage trip-point temperature coefficient | note 2 | – | $\pm 100 \times 10^{-6}$ | $\pm 400 \times 10^{-6}$ | mV/K |
| $V_{hys}$ | voltage trip-point hysteresis | | 15 | 30 | 50 | mV |

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| **COMIN** | | | | | | |
| $V_{SP}$ | COMIN switch point | $T_{amb}$ = 25 °C; note 1 | 1.28 | 1.30 | 1.32 | V |
| $\Delta V_{SP}$ | COMIN switch point temperature coefficient | note 2 | – | ±0.1 | ±0.5 | mV/K |
| **SELECT** | | | | | | |
| $V_{IL}$ | LOW level input voltage | | – | – | $0.3V_{DD}$ | V |
| $V_{IH}$ | HIGH level input voltage | | $0.7V_{DD}$ | – | – | V |
| **SELECT and COMIN** | | | | | | |
| $I_{LI}$ | LOW level leakage input current | | – | – | –1.0 | µA |
| $I_{LI}$ | HIGH level leakage input current | | – | – | 1.0 | µA |
| **$\overline{\text{POWF}}$, RESET and COMOUT** | | | | | | |
| $I_O$ | output sink current | $V_O$ = 0.4 V; $V_{DD}$ = 2.4 V; see Fig.6 | 1 | 3 | – | mA |
| $I_O$ | output source current | $V_O$ = 2.0 V; $V_{DD}$ = 2.4 V; see Fig.7 | –0.75 | –2 | – | mA |
| $t_R$ | reset time | $C_{CT}$ = 1 nF; note 3 | 400 | 1000 | 2000 | µs |
| $t_S$ | save time | $C_{CT}$ = 1 nF; note 3 | 40 | 100 | 200 | µs |
| $t_R/t_S$ | reset to save time ratio | | – | 10 | – | |
| $C_{int}$ | CT internal capacitance | | – | 100 | – | pF |

**Notes**

1. Long time stability of COMIN switch point $V_{SP}$ and voltage trip point $V_{TRIP}$: within 10 years of continuous operation at $V_{DD(max)}$ and an average operating temperature of 55 °C the drift of $V_{SP}$ will not exceed ±10 mV. The maximum drift for $V_{TRIP}$ will not exceed $(\pm V_{TRIP(typ)}/V_{SP(typ)})$ 10 mV.
2. Values given per degree Kelvin; tested on a sample basis.
3. Conformance to these specifications is only guaranteed if the slew rate of $V_{DD}$ is less than 25 V/ms.




$t_R$ = reset time (duration of reset pulse).

$t_S$ = save time (time between assertion of $\overline{POWF}$ and assertion of the reset output). This time can be used for storing of critical data and orderly system shut-down.

$V_{hys}$ = hysteresis voltage (prevents oscillation around $V_{TRIP}$).

Fig.3 Timing diagram.

**Typical performance characteristics**

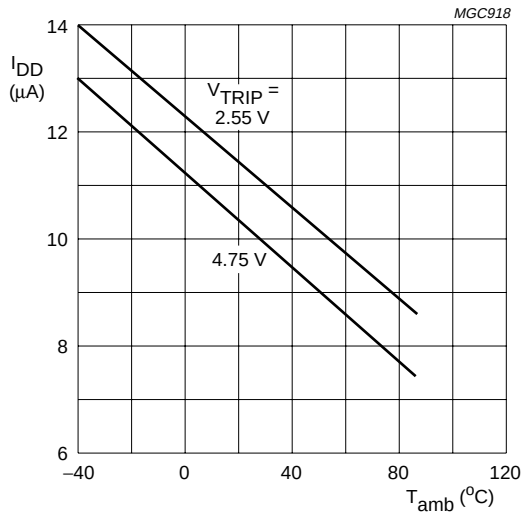



Fig.4 Supply current as a function of temperature; $V_{DD}$ = 5 V; COMIN = $V_{DD}$.

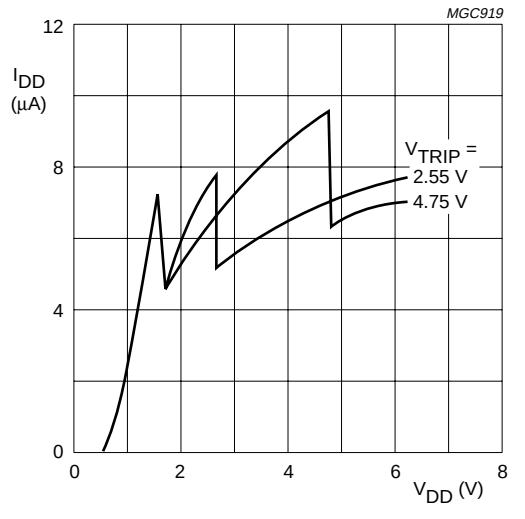



Fig.5 Supply current as a function of the supply voltage; $T_{amb}$ = +25 °C.

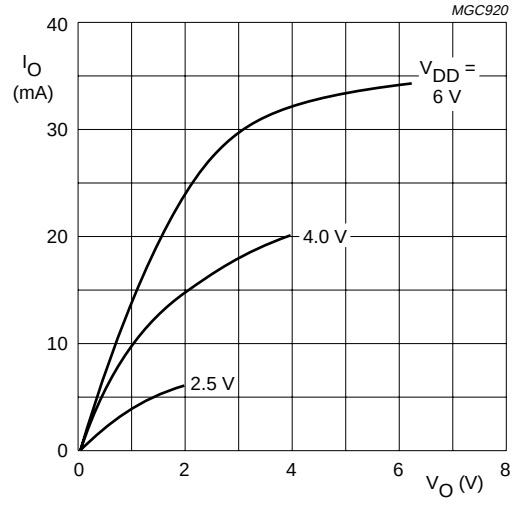



Fig.6 Output sink current as a function of the output voltage.

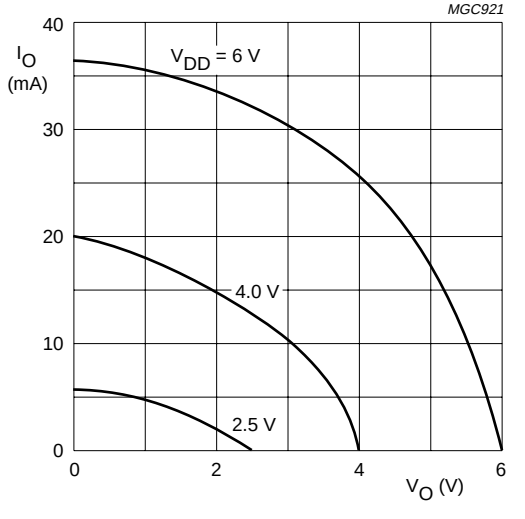
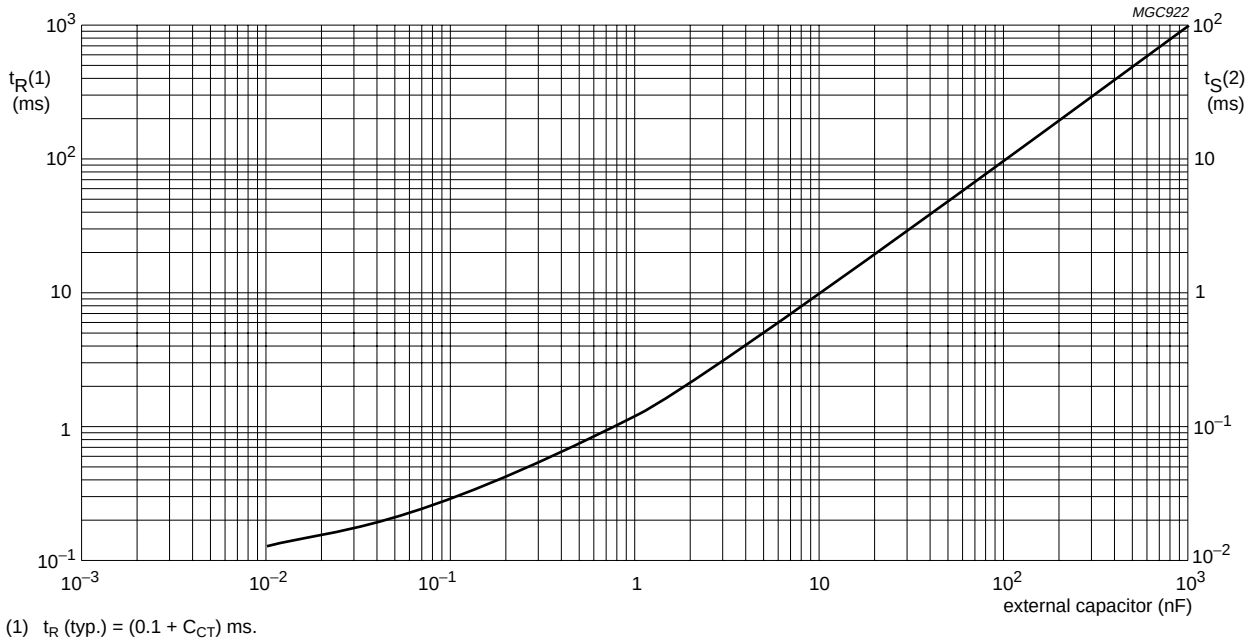



Fig.7 Output source current as a function of the output voltage.




(1) $t_R$ (typ.) = (0.1 + $C_{CT}$) ms.

(2) $t_S$ (typ.) = (0.01 + 0.1 $C_{CT}$) ms.

Fig.8 Reset and save times as a function of the external capacitor ($C_{CT}$).

**APPLICATION INFORMATION**

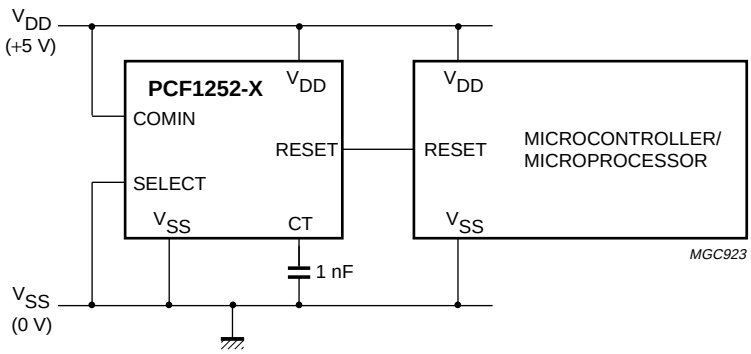



Fig.9 Typical power-on reset circuit for a microcontroller/microprocessor system; (when not used, COMIN must be connected to $V_{DD}$).

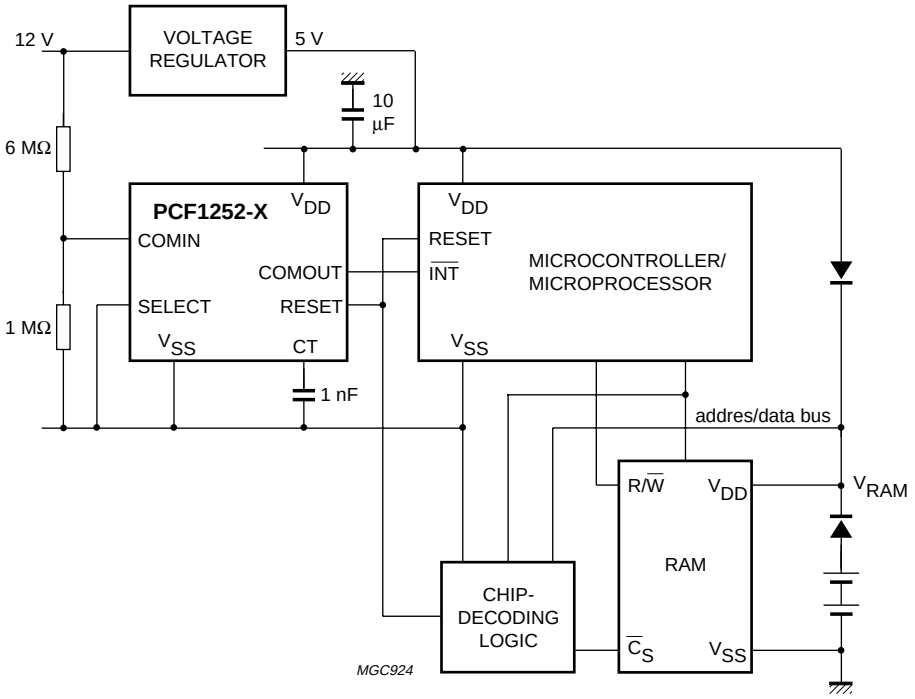
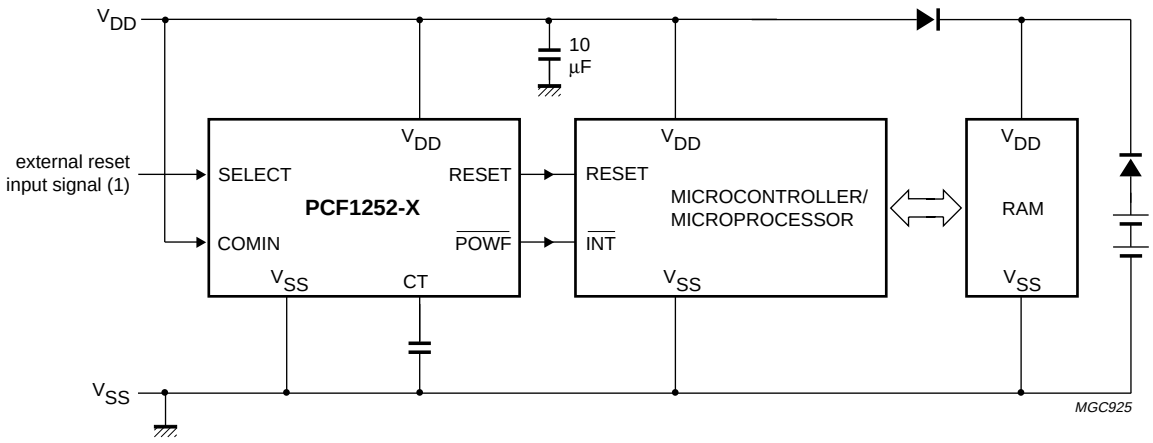



Fig.10 Data retention circuit for memory back-up systems.

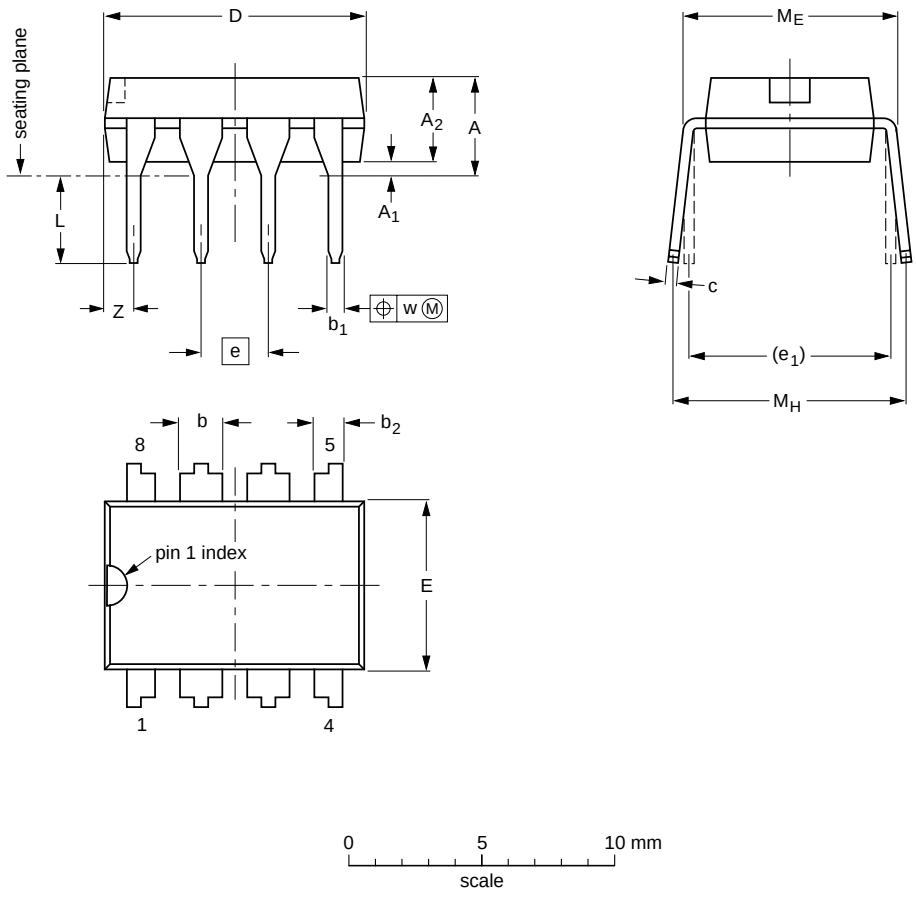



(1) For external reset application, the SELECT input must be debounced.

Fig.11 Data retention circuit with external switchable reset for systems with a single voltage supply.

## PACKAGE OUTLINES

**DIP8: plastic dual in-line package; 8 leads (300 mil)** **SOT97-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

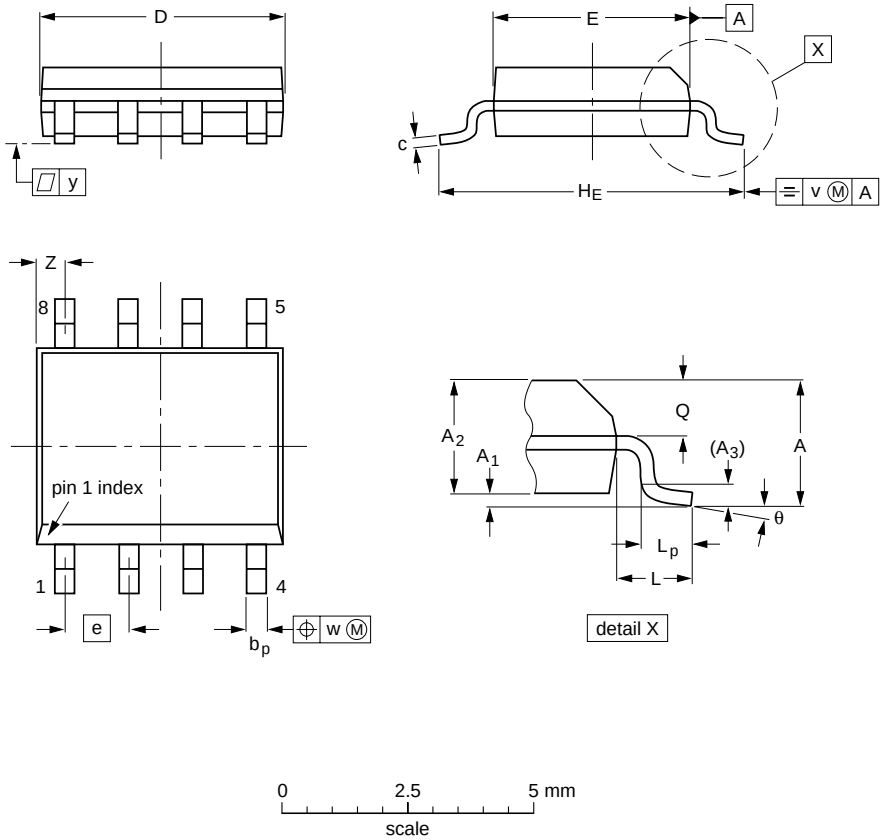
| UNIT | A max. | $A_1$ min. | $A_2$ max. | b | $b_1$ | $b_2$ | c | D (1) | E (1) | e | $e_1$ | L | $M_E$ | $M_H$ | w | Z (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.2 | 0.51 | 3.2 | 1.73<br>1.14 | 0.53<br>0.38 | 1.07<br>0.89 | 0.36<br>0.23 | 9.8<br>9.2 | 6.48<br>6.20 | 2.54 | 7.62 | 3.60<br>3.05 | 8.25<br>7.80 | 10.0<br>8.3 | 0.254 | 1.15 |
| inches | 0.17 | 0.020 | 0.13 | 0.068<br>0.045 | 0.021<br>0.015 | 0.042<br>0.035 | 0.014<br>0.009 | 0.39<br>0.36 | 0.26<br>0.24 | 0.10 | 0.30 | 0.14<br>0.12 | 0.32<br>0.31 | 0.39<br>0.33 | 0.01 | 0.045 |

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT97-1 | 050G01 | MO-001AN | | | | ~~92-11-17~~<br>95-02-04 |

**SO8: plastic small outline package; 8 leads; body width 3.9 mm** **SOT96-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(2)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 5.0<br>4.8 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.20<br>0.19 | 0.16<br>0.15 | 0.050 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT96-1 | 076E03S | MS-012AA | | | | ~~95-02-04~~<br>97-05-22 |

## SOLDERING

### Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (order code 9398 652 90011).

### DIP

#### Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

#### Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

### SO

#### Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

#### Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

#### Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

## DEFINITIONS

| **Data sheet status** | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
| **Application information** | |
| Where application information is given, it is advisory and does not form part of the specification. | |

## LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

**NOTES**

**NOTES**

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